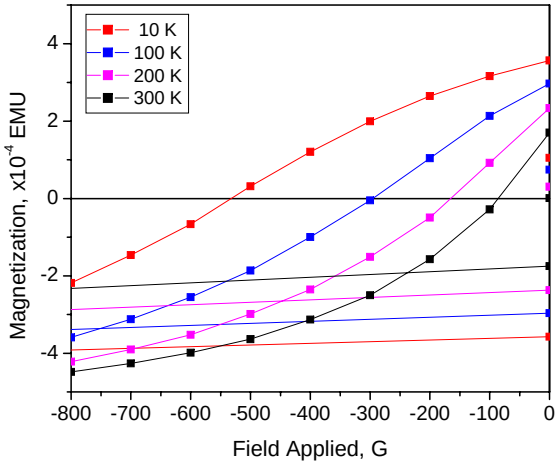
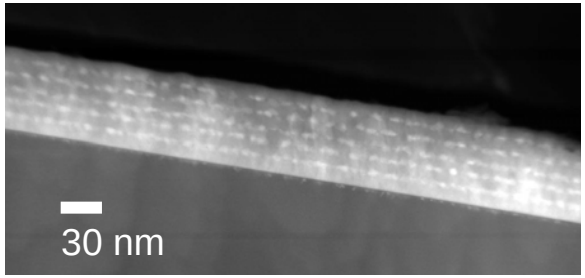
Synthesis and Characterization of Self-assembled Nanoscale Magnetic Particles

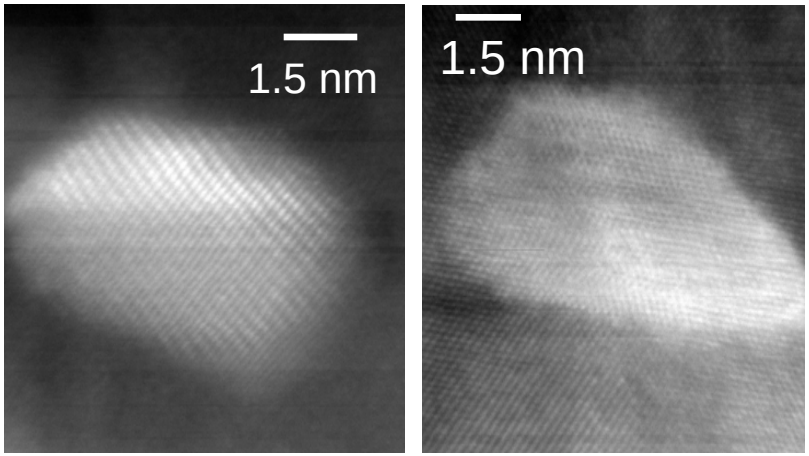
D. Kumar, North Carolina A & T State University, DMR-0303552

Motivation: To make self-assembled epitaxial nanomagnetic particles in a thin film matrix with enhanced magnetic properties.



Magnetization as a function of field measurements on a Fe-TiN nanocomposite thin film showed large coercivity values.





Top: STEM-Z image of Fe-particles embedded in TiN thin film matrix. The image shows that the sample is homogeneous over long lateral distances. Particles with coherent structure with respect to matrix and having different shapes (spherical: bottom left; triangular: bottom right) have also been prepared in TiN thin film matrix.

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Education:

Ms. S. Dana, Department of Mechanical and Chemical Engineering, working on NER project is graduating as a Master student in 2004 Fall semester. Presently there are two undergraduate students (Julius Steed and Jordon Jeffery) also working on this project. The purpose of supporting them is motivate them to join MS/Ph.D. program at NCAT or to prepare them for high tech industrial jobs in the area of nanoscience and nanoengineering.

Early intervention:

The PI had taken Anthony Polzine (freshman undergraduate student with Mechanical Engineering major) to 2004 MRS Spring Meeting in San Francisco. The student had a direct opportunity to interact with researchers and listen to their technical presentations. This interaction has inspired him to get more involved in advanced nanoscience research at NCAT. He is now participating in the NSF-NIRT project at NCAT of which the PI is the project director.

K-12 interaction:

The PI had been interacting with Principals of the local schools in North Carolina Guilford County- Monticello Brown Summit (BSM) Elementary and BSM Magnet Middle School for Science and Technology- to develop a plan to cultivate in students and teachers an interest in nanoscience and its importance in day-today life. Under this plan, the PI will arrange a field trip for students and teachers from these two schools to NCAT campus where they will see the advanced research equipments and hear from the graduate and senior undergraduate students about the research they are doing in the area of nanomaterials.

Publication:

"Pulsed laser deposition assisted novel synthesis of self-assembled magnetic nanoparticles," Composites Part B: engineering, Volume 35, 149-155 (2004).

"Mechanical properties of nanocomposite metal ceramic thin films," Composites Part B: engineering, Volume 35, pp. 157 (2004).

"The structural characterization and magnetic measurements data are new and will be submitted for publication in Applied Physics Letters."